Coordinated Surveillance, Forecasting and Risk Warning Systems for Field Crop Insect Pests of the Prairie Ecosystem

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Project Code: CARP SCDC/WGRF 2014.1
Final Report: March 2019

Recognizing that an area-wide monitoring of pest and natural enemy populations is a cornerstone of integrated pest management, researchers initiated a project to develop a coordinated monitoring program in the prairies. The result is the Prairie Pest Monitoring Network (PPMN), which generated a weekly summary of weather, crop and insect pest information during the growing season that alerts growers and industry to emerging pest issues, areas of potentially high pest pressure, and raises the profile of natural enemies and their role in pest management. The project also developed 14 monitoring protocols and predictive models for key insect pests to assist the industry manage issues related to climate change, new agronomic practices, and new crops.

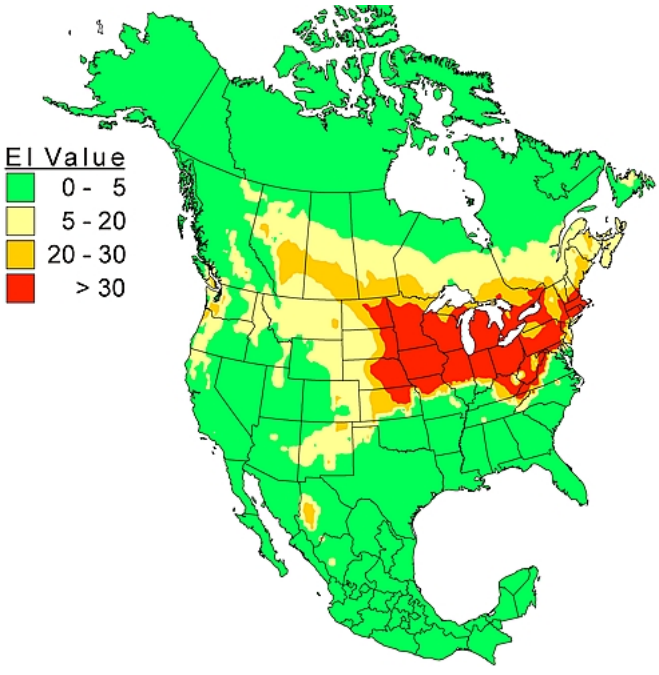
Across western Canada, invasive and endemic insect pests associated with major field crops have potential to cause significant crop yield and quality losses. Recognizing that an area-wide monitoring of pest and natural enemy populations is a cornerstone of integrated pest management, researchers initiated a four-year project in 2014 to develop a coordinated monitoring program in the prairies, the Prairie Pest Monitoring Network (PPMN). The goal of the project was to help guide crop selection, agronomic practices, and in-field scouting efforts to support informed decision-making for pest control for growers and industry.

Led by researchers from Agriculture and Agri-Food Canada in Saskatoon, along with several collaborators across western Canada, the objectives of this project were to coordinate insect surveillance programs prairie-wide by: (i) Developing and implementing field surveillance technologies and laboratory assays for insect pests and their natural enemies (Monitoring Protocols); (ii) Developing forecast and risk assessment technologies (Risk Warning Methods); and (iii) Developing technology transfer and communication tools that contribute to the development of risk-reduction strategies.

During the project, a total of 14 monitoring protocols were developed and tested, and are currently maintained on the Prairie Pest Monitoring Network Blog. The site includes protocols for key insect pest forecasting, distribution/abundance, and collaborative research protocols. All protocols include biological information, suggested monitoring methods for the pest, descriptions of the damage it causes and, whenever possible, economic or nominal thresholds to enable informed pest management decisions. The protocols were reviewed and updated by subject matter experts in Spring 2019.

Annual pest surveys were conducted over the four-years of the project, including the use of abiotic data (including wind trajectories), to provide weekly updates on insect activity during the growing season and produce annual distribution and forecast maps. This information is communicated to industry stakeholders using a variety of technology transfer vehicles, including the Prairie Pest Monitoring Network Blog. Long-term surveys of insect populations provided a general overview of pest and natural enemy population trends over time. Researchers are continuing to compile and incorporate data into the insect population trend database for analysis of factors influencing population increase and decrease over time.

In the 2018 annual pest surveys, the greatest number of sites were sampled during the growing season. Provincial and industry collaborators, together with project team members across the Prairies, monitored 3047 sites for grasshoppers, 733 for wheat midge, 597 for cabbage seedpod weevil, 635 for bertha armyworm, 471 sites for pea leaf weevil, and 102 for wheat stem sawfly. In addition, sentinel sites were monitored for flea beetles, swede midge, *Contarinia brassicola* (a newly discovered species of midge attacking canola flowers), and cereal leaf beetle. The potential for migratory pest species, such as diamondback moth and leafhoppers and cereal rusts, was assessed using wind trajectory data (in collaboration with Environment and Climate Change Canada). Back trajectory data from 60 sites in Canada and forward trajectory data from 20 sites in USA and Mexico were assessed on a daily basis during each growing season (12,000 maps at three wind altitudes).



Researchers also used the annual and long-term pest survey data to assist in developing predictive models for key insect pests to assist the industry manage issues related to climate change, new agronomic practices, and new crops. Climate is the dominant force determining the distribution and abundance of most insect species. Bioclimate models continue to be developed to predict the geographic range and abundance for regions where species of interest do not currently occur.

Figure 1. Bioclimate model results of the potential range and relative abundance of crucifer flea beetle (*Phyllotreta cruciferae*) populations in North America and Mexico. Ecoclimatic Index (EI) values >20 suggest regions that are favourable.

The PPMN project has successfully developed and maintained a coordinated monitoring program in the prairies. During the growing season, information generated by the PPMN provides a weekly summary of weather, crop and insect pest information that alerts growers and industry to emerging pest issues, areas of potentially high pest pressure, and raises the profile of natural enemies and their role in pest management. The next iteration of the Prairie Pest Monitoring Network has been funded by the Canadian Agricultural Partnership Integrated Crop Agronomy Cluster, and will continue until March 2023. http://prairiepestmonitoring.blogspot.com

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